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# ITU-R studies on Spectrum Monitoring

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# International spectrum management framework



ITU Constitution,  
Convention

Plenipoten-  
tiary Conf.

High level principles

Radio Regulations  
Bi/multilateral Agreements

WRC  
RRC  
RRB

Rights and Obligations  
Table of Frequency Allocations  
Satellite orbit/terrestrial Plans  
Frequency coordination  
Frequency registration  
Interference  
Rules of Procedure...

ITU-R Recommendations

RA



ITU-R Reports,  
Handbooks, software tools

Study Groups  
WPs, TGs

Technical characteristics  
Sharing criteria/assessment  
Spectrum management  
Operational aspects ...

**RRB: Radio Regulations Board**  
**RRC: Regional Radiocommunication Conference**  
**WRC: World Radiocommunication Conference**

**RA: Radiocommunication Assembly**  
**WPs: Working Parties**  
**TG: Task Groups**

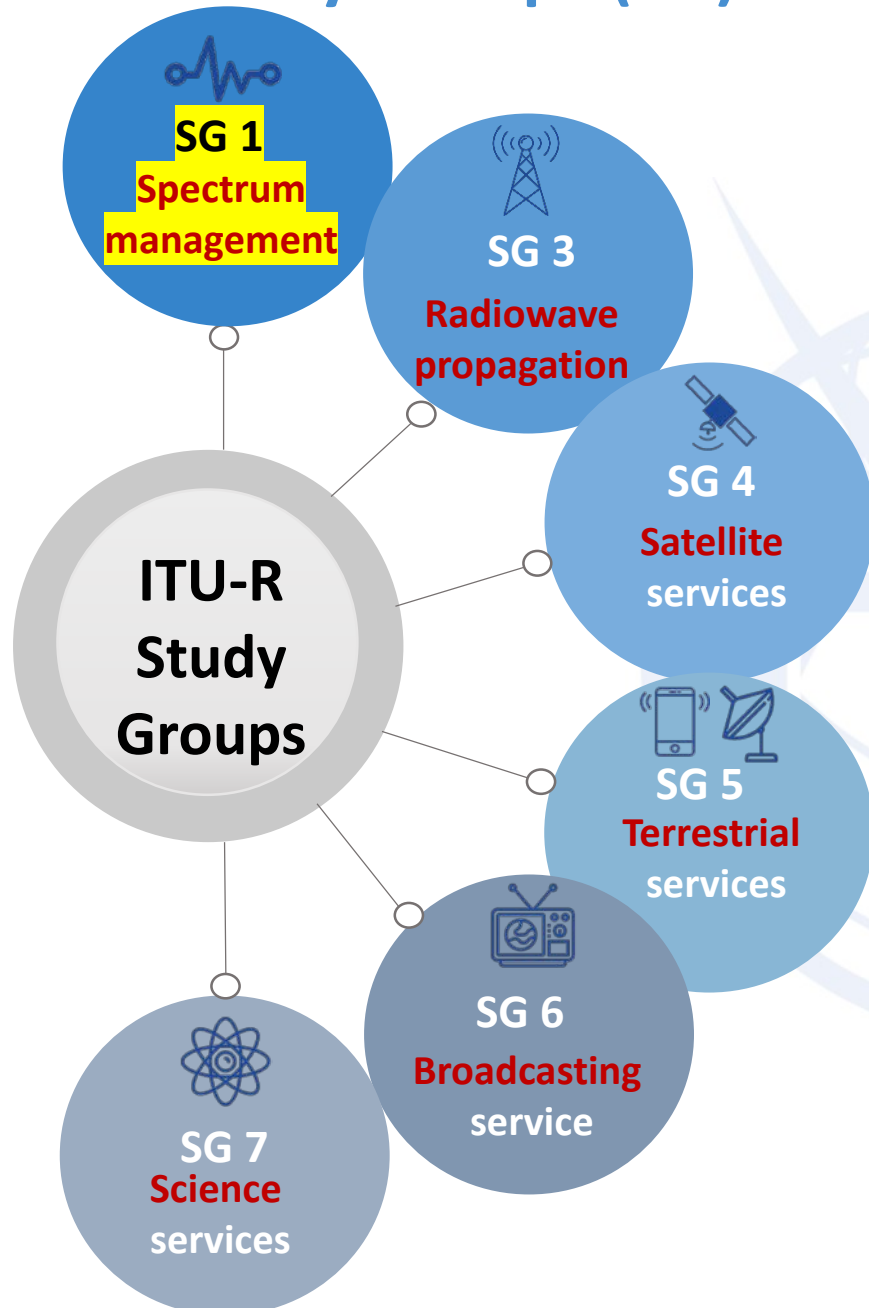
# Radiocommunication Assembly 2019

- Held on 21 – 25 October 2019, in Sharm El-Sheikh, Egypt
- **521** participants, **91** ITU Member States, **48** ITU-R Sector members
- Maintained the ITU-R structure with **6 ITU-R Study Groups**, **CCV**, **RAG** and **CPM**, Appointed **Chairmen and Vice-Chairmen** of these groups (see [Res. ITU-R 4-8](#) & [Doc. 84](#))  
Approved **programme of work/Questions** ([Res. ITU-R 5-8](#)) & **working methods** (Res. ITU-R [1-8](#) & [2-8](#))
- Approved **23** revised **ITU-R Resolutions** and **2** new **ITU-R Resolutions** (on broadcasting)
- Approved **5** ITU-R Recommendations (including one on frequency arrangements for terrestrial IMT)





# ITU-R Study Groups (SG)



## SG 1

- [WP 1A](#) – Spectrum engineering techniques
- [WP 1B](#) – Spectrum management methodologies and economic strategies
- [WP 1C](#) – Spectrum monitoring

## SG 3

- [WP 3J](#) – Propagation fundamentals
- [WP 3K](#) – Point-to-point propagation
- [WP 3L](#) – Ionospheric propagation and radio noise
- [WP 3M](#) – Point-to-point and Earth-space propagation

## SG 4

- [WP 4A](#) – Efficient orbit/satellite utilization for FSS and BSS
- [WP 4B](#) – Systems, air interfaces, performance and availability objectives for FSS, BSS and MSS (incl. IP-based applications and SNG)
- [WP 4C](#) – Efficient orbit/satellite utilization for MSS and RDSS

## SG 5

- [WP 5A](#) – Land mobile > 30 MHz, fixed WAS, amateur & amateur-satellite
- [WP 5B](#) – Maritime and aeronautical mobile services and radiodetermination
- [WP 5C](#) – HF and other systems < 30 MHz in the fixed and land mobile services
- [WP 5D](#) – IMT systems

## SG 6

- [WP 6A](#) – Terrestrial broadcasting delivery
- [WP 6B](#) – Broadcast service assembly and access
- [WP 6C](#) – Programme production and quality assessment
- [TG 6/1](#) – **WRC-23 agenda item 1.5** (use of the band 470-960 MHz)



## SG 7

- [WP 7A](#) – Time signals and frequency standard emissions
- [WP 7B](#) – Space radiocommunication applications: space operation, space research, Earth exploration, meteorological satellite services
- [WP 7C](#) – Remote sensing systems (active and passive): Earth exploration-satellite, MetAids, space research services
- [WP 7D](#) – Radio astronomy

# ITU-R Study Groups Products

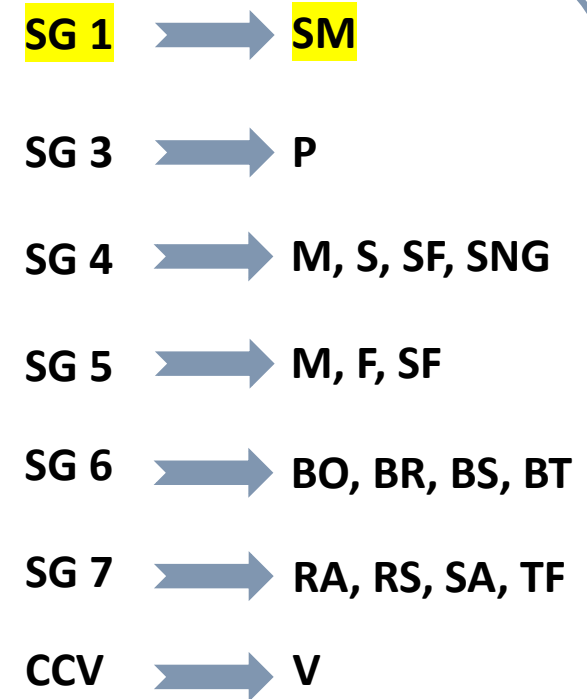
- ITU-R Recommendations
- ITU-R Reports and Handbooks
- Technical bases for radio conferences





# ITU-R Recommendations/Report series

Series	Title
BO	Satellite delivery
BR	Recording for production, archival and play-out; film for television
BS	Broadcasting service (sound)
BT	Broadcasting service (television)
F	Fixed service
M	Mobile, radiodetermination, amateur and related satellite services
P	Radiowave propagation
RA	Radio astronomy
RS	Remote sensing systems
S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
<b>SM</b>	<b>Spectrum management</b>
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
V	Vocabulary and related subjects



[BR Publication Search Tool](#)



# Description of the texts\* assigned to the ITU-R Study Groups and sub-groups

- **Spectrum Management** (SG 1, see [Doc. 1/1](#))
- **Radiowave Propagation** (SG 3, see [Doc. 3/1](#))
- **Satellite Services** (SG 4, see [Doc. 4/1](#))
- **Terrestrial Services** (SG 5, see [Doc. 5/1](#))
- **Broadcasting Service** (SG 6, see [Doc. 6/1](#))
- **Science Services** (SG 7, see [Doc. 7/1](#))

\* ITU-R Questions, Recommendations, Reports, Handbooks, Resolutions, Opinions, Decisions  
W(A)RC Resolutions and Recommendations

## ITU-R Collaboration with other sectors and organizations

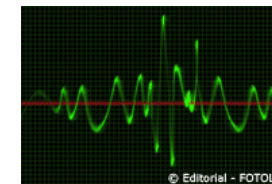
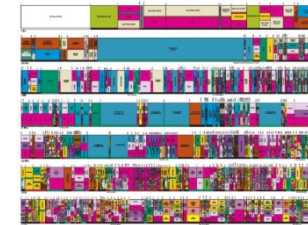
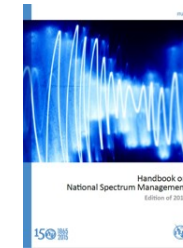
- ITU-T ([Res. ITU-R 6-3](#))
- ITU-D ([Res. ITU-R 7-4](#))
- Other relevant organizations, incl. ISO, IEC & CISPR ([Res. ITU-R 9-6](#))

# Study Group 1

## Spectrum Management

Propagation of radio waves in ionized and non-ionized media and the characteristics of radio noise, for the purpose of improving radiocommunication systems

- **Spectrum management**  
**-principles & techniques**
- **General principles of sharing**
- **Spectrum monitoring**
- **Long-term strategies for spectrum utilization**
- **Economic approaches to national spectrum management**



Chairman: Mr. Wael SAYED

Counsellor: Mr. Philippe AUBINEAU



# SG 1 & WPs Chairmen & Vice-Chairmen

## Study Group 1 – Spectrum Management (details [online](#))

**Chairman:** Mr W. SAYED \* Egypt (Arab Rep. of) \* *New since RA-19 (see [Res. ITU-R 4-8](#))*

**Vice-Chairmen:**

Mr M. AYOUB \* Lebanon  
 Mr G. ABDULLAYEV\* Azerbaijan (Rep. of)  
 Mr. A.W. AHMED\* Iraq (Rep. of)  
 Mr J.A. AL MAHRUQI Oman (Sultanate of)  
 Mr G. CHAND\* India (Rep. of)  
 Mr S. COULIBALY\* Mali (Rep. of)  
 Mr R. GARCIA DE SOUZA\* Brazil (Federative Rep. of)  
 Mr M. HAJI \* Kenya (Republic of)  
 Mr T.H. LE Viet Nam (Socialist Rep. of)

**Vice-Chairmen:**

Dr I.-K. LEE Korea (Rep. of)  
 Mr A. NALBANDIAN\* Armenia (Rep. of)  
 Dr G. OWEN Netherlands (Kingdom of the)  
 Dr A. SCOTTI Italy  
 Ms B. SYKES United States of America  
 Ms. T. SUKHODOLSKAIA\* Russian Federation  
 Mr. Z. ZHAO\* China (People’s Rep. of)  
 Mrs S. ZAIRI\* Morocco (Kingdom of)

## Working Party 1A – Spectrum engineering techniques (details [online](#))

**Chairman:** Mr R. GARCIA DE SOUZA Brazil (Federative Rep. of)  
**Vice-Chairman:** Dr G. OWEN Netherlands (Kingdom of the)

## Working Party 1B – Spectrum management methodologies and economic strategies (details [online](#))

**Chairman:** Mr L. KIBET BORUETT Kenya (Rep. of)  
**Vice-Chairman:** Mr B. LIU China (People's Rep. of)

## Working Party 1C – Spectrum monitoring (details [online](#))

**Chairman:** Mr R. TRAUTMANN Germany (Federal Rep. of)  
**Vice-Chairman:** Mr M. AL-SAWAFI Oman (Sultanate of)

# RA Resolutions of interest to SG 1

Res. ITU-R	Title	WP
<u>11-5</u>	Further development of the <b>SM system for developing countries</b>	1A
<u>22-5</u> *	Improvement of <b>national radio SM practices and techniques</b>	1B
<u>23-3</u>	Extension of the <b>international monitoring system</b> to a worldwide scale	1C
<u>54-3</u> *	Studies to achieve <b>harmonization for short-range devices</b>	1B **
<u>55-3</u> *	ITU studies of <b>disaster prediction, detection, mitigation and relief</b>	1B, 1C
<u>58-2</u> *	Studies on the <b>implementation and use of cognitive radio systems</b>	1A, 1B, [1C]
<u>59-2</u> *	Studies on availability of frequency bands for worldwide and/or regional harmonization and conditions for their use by <b>terrestrial electronic news gathering systems</b>	1B
<u>60-2</u> *	<b>Reduction of energy consumption</b> for environmental protection and mitigating climate change by use of ICT/radiocommunication technologies and systems	1B
<u>61-2</u> *	ITU-R's contribution in <b>implementing the outcomes of the World Summit on the Information Society and the 2030 Agenda for Sustainable Development</b>	1A, 1B
<u>62-2</u> *	Studies related to <b>testing for conformance</b> with ITU-R Recommendations <b>and interoperability</b> of radiocommunication equipment and systems	1B
<u>64</u>	Guidelines for the <b>management of unauthorized operation of earth station terminals</b>	1B, 1C
<u>66-1</u> *	Studies related to <b>wireless systems and applications for the development of the Internet of Things (IoT)</b>	1A, 1B
<u>67-1</u> *	<b>Telecommunication/ICT accessibility</b> for persons with disabilities and persons with specific needs	All 3

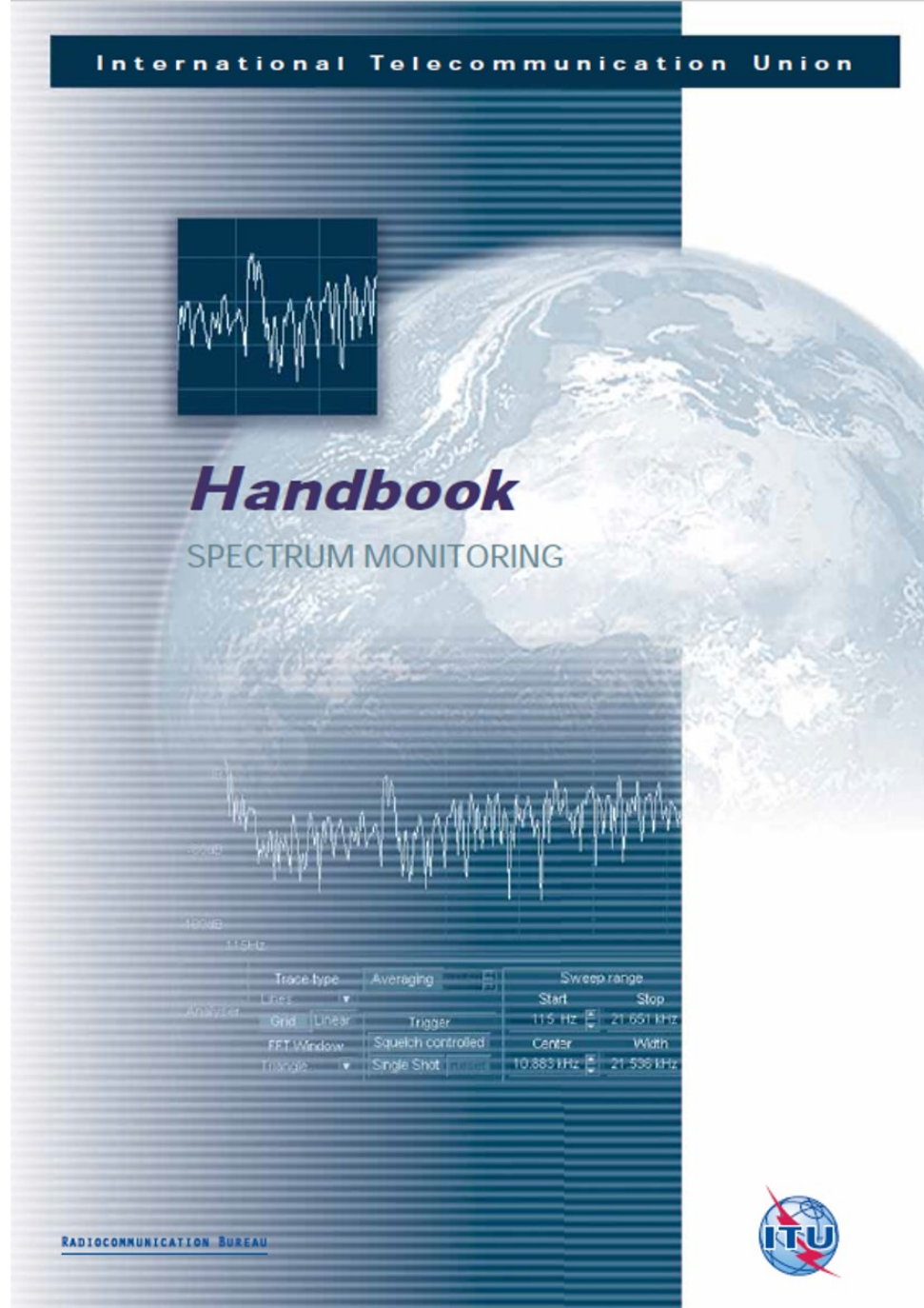
\* Revised at RA-19 \*\* Working Party 1A may also be involved upon request from Working Party 1B



# ITU-R Questions within SG 1

Question ITU-R	Title	WP
<a href="#">205-2/1</a>	Long-term strategies for spectrum utilization	1B
<a href="#">208-1/1</a>	Alternative methods of national spectrum management	1B
<a href="#">210-3/1</a>	Wireless power transmission (WPT)	1A *
<a href="#">216-1/1</a>	Spectrum redeployment as a method of national spectrum management	1B
<a href="#">221-2/1</a>	Compatibility between radiocommunication systems and high data telecommunication systems using wired electrical power supply	1A
<a href="#">222/1</a>	Definition of the spectral properties of transmitter emissions	1A
<a href="#">232/1</a>	Methods and techniques used in space radio monitoring	1C
<a href="#">235/1</a>	Spectrum monitoring evolution	1C
<a href="#">236/1</a>	Impact on radiocommunication systems from wireless & wired data transmission technologies used for the support of power grid management systems	1A
<a href="#">237/1</a>	Technical and operational characteristics of the active services operating in the range 275-1 000 GHz	1A
<a href="#">238/1</a>	Characteristics for use of visible light for broadband communications	1A
<a href="#">239/1</a>	EMF measurements to assess human exposure	1C
<a href="#">240/1</a>	Assessment of spectrum efficiency and economic value	1B
<a href="#">241/1</a>	Methodologies for assessing or predicting spectrum availability	1B

\* Question ITU-R 210-3/1 was assigned to both Working Parties 1A and 1B prior to the June 2019 meeting of SG 1.11



# ITU's worldwide recognized reference on Spectrum Monitoring and related issues

- Chapter 5.6 on **Non-Ionizing Radiation (NIR) measurements**
  - Explains **NIR limits & exposure quotient**
  - **Instruments for NIR measurements**
    - Broadband isotropic probes and meters
    - Tri-axis antennas and field strength meters
    - Transportable station
    - standard field strength measurement equipment
  - **Measurement procedures** for different radio services (incl. mobile, broadcasting, etc.)
  - **Reporting methods**

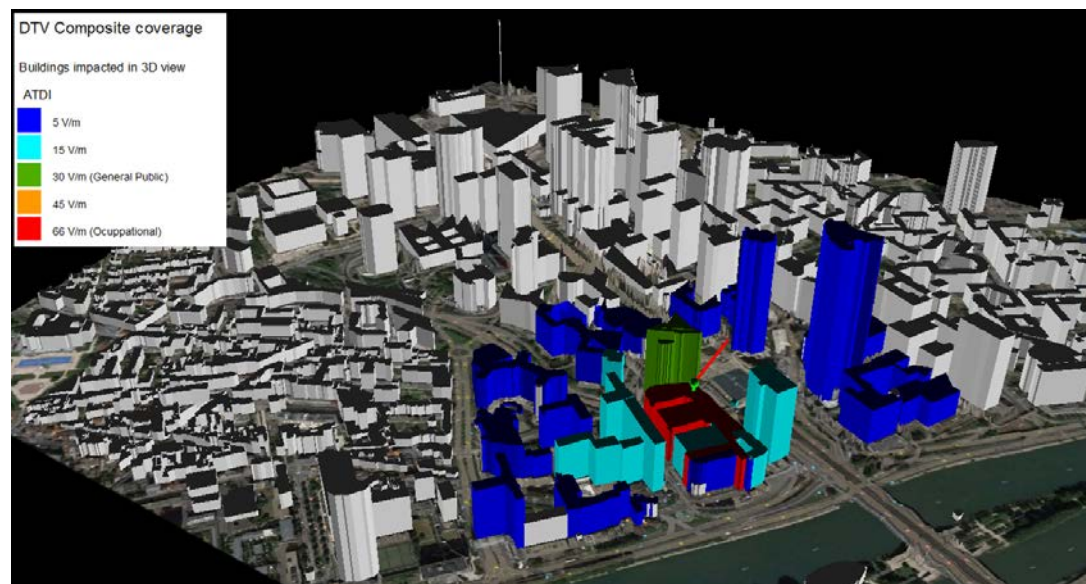


# On-going ITU-R Studies on EMF measurements to assess human exposure

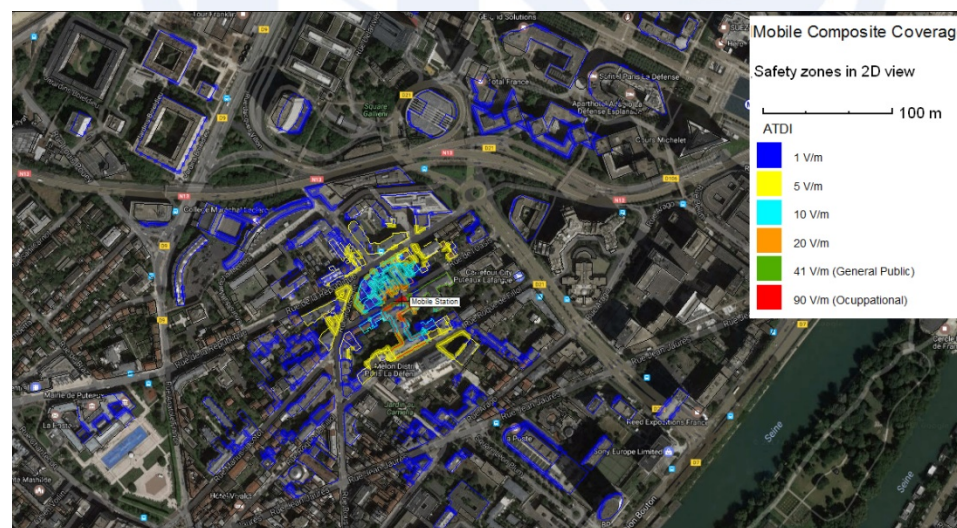
- WP 1C studies in response to Question ITU-R 239/1
  1. What are the **measurements techniques** to assess the human exposure from wireless installations of all types?
  2. How can **measurement results** be presented?
- First studies completed in 2019
- Approval of Report ITU-R SM.2452-0
- Studies will continue at the next ITU-R WP 1C meeting from 24 November to 2 December 2020, including references to the recent publications of ICNIRP (2020) (replacing the 100 kHz to 300 GHz part of the ICNIRP (1998) guidelines)

# Presenting maps of calculated field-strength around transmitters, e.g.

## Three dimensions DTV general-public and occupational exposure-contours



## Two dimensions satellite view of cellular exposure-distances



# A practical guide for EMF measurements to assess human exposure

- **Basic knowledge for a successful EMF assessment measurement process**
- **Measurement instruments with specific features for EMF assessment**

- **Personal monitor**



- **Broadband meters**



- **Frequency selective meters**



Frequency selective meter dedicated to EMF, with isotropic-antenna

Handheld spectrum analyser with isotropic-antennas, 9 kHz to 6 GHz



- **Reducing the number of measurement points in space**
- **Reducing the observation time and extrapolation to the maximal exposure**
- **How to assess the exposure due to specific services**
  - **General approach for services where extrapolation is not required**
  - **GSM base stations      - UMTS base stations      - LTE base stations      - Wi-Fi access points**



# Other WP 1C on-going studies (1/2)

## ✓ on Performance evaluation of mobile DF units in operational environment

- WD PDN Rec. ITU-R SM.[MOB DF PERF] (Annex 1 to the [WP1C Chairman's Report](#))
- *Rapporteur Group Mailing List:* [rwp1c-cg-mob-df@itu.int](mailto:rwp1c-cg-mob-df@itu.int) ([SharePoint](#)),  
*Rapporteur:* **Mr A. Agius** (see ToR in Annex 2 to the [WP1C Chairman's Report](#))

## ✓ on Population coverage measurement with public wireless networks

- WD PDN Rep. ITU-R SM.[POPULATION\_COVERAGE] (Annex 14 to the [WP1C Chairman's Report](#))
- *Correspondence Group (CG) Mailing List:* [rwp1c-cg-pop-cov@itu.int](mailto:rwp1c-cg-pop-cov@itu.int) ([SharePoint](#))  
*Chairman:* **Mr V. Blagodarnyi**

## ✓ on Test procedure for measuring accuracy of TDOA emitter location systems

- [WD]PDN Rec. ITU R SM.[TDOA-ACC] (see Annex 6 to the [WP1C Chairman's Report](#))
- *CG ML:* [rwp1c-cg-tdoa-acc@itu.int](mailto:rwp1c-cg-tdoa-acc@itu.int) ([SharePoint](#)), *Chairman:* **Mr J. Yang**

## ✓ on Essential requirements for a spectrum monitoring system for developing countries

- PDR of Rec. ITU-R [SM.1392-2](#) (see Annex 7 to the [WP1C Chairman's Report](#))
- *CG ML:* [rwp1c-cg-1392@itu.int](mailto:rwp1c-cg-1392@itu.int) ([SharePoint](#)), *Chairman:* **Mr M. Al-Sawafi**

## ✓ on Reporting harmful interference in support of RR Appendix 10

- WD PDN [Rec./Rep.] ITU-R SM.[APP10] (see Annex 11 to the [WP1C Chairman's Report](#))





## Other WP 1C on-going studies (2/2)

### ✓ on Test procedure for measuring monitoring system field strength measurement accuracy in the VHF/UHF frequency range

- WD PDN Rec. ITU-R SM.[FS-ACC] (see Annex to the [WP1C Chairman's Report](#))
- CG ML: [rwp1c-cg-fs-accuracy@itu.int](mailto:rwp1c-cg-fs-accuracy@itu.int) ([SharePoint](#)), Chairman: Mr J. Wang

### ✓ on Use of commercial drones operating within visible line of sight for measurement of own country spectrum

- WD PDN Report ITU-R SM.[UAVs] (see Annex 3 to the [WP1C Chairman's Report](#))
- CG ML: [rwp1c-cg-uav-mon@itu.int](mailto:rwp1c-cg-uav-mon@itu.int) ([SharePoint](#)),  
Chairman: Dr. K. Kim ([kangheekim@etri.re.kr](mailto:kangheekim@etri.re.kr)) (see ToR in Annex 4 to the [WP1C Chairman's Report](#))

### ✓ on Use of small satellites for Spectrum Monitoring

- WD PDN Report ITU-R SM.[SMALL-SAT] (see Annex 9 to the [WP1C Chairman's Report](#))
- CG ML: [rwp1c-cg-small-sat@itu.int](mailto:rwp1c-cg-small-sat@itu.int) ([SharePoint](#)),  
Chairman: Mr C. Hao (see ToR in Annex 10 to the [WP1C Chairman's Report](#))

### ✓ on Spectrum Monitoring Handbook

- CG ML: [rwp1c-handbook@itu.int](mailto:rwp1c-handbook@itu.int) ([SharePoint](#))  
Chairman: Mr R. Trautmann (see ToR in Annex 12 to the [WP1C Chairman's Report](#))

# Thank you for your attention

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Counsellor for ITU-R SG1 & CPM

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ITU-R Study Group 1:

[www.itu.int/ITU-R/go/rsg1](http://www.itu.int/ITU-R/go/rsg1), Email: [rsg1@itu.int](mailto:rsg1@itu.int)

ITU-R Working Party 1C:

[www.itu.int/ITU-R/go/rwp1c](http://www.itu.int/ITU-R/go/rwp1c)

## Additional slides on

➤ **Relevant ITU-R Recommendations & Reports approved in 2019**

➤ Opportunities to participate/contribute to the next WP 1C e-meeting from 24 November to 2 December 2020 (see details in BR [1/LCCE/106](#))



[ITU-R Study Groups](#)



# WP 1C approved publications after May-June 2019 (1/2)

- ✓ **Studies on Method of measuring the maximum frequency deviation of FM broadcast emissions at monitoring stations**
  - Rec. ITU-R [SM.1268-5](#) (Approved in Aug. 2019)
- ✓ **Studies on Monitoring of radio emissions from spacecraft at monitoring stations**
  - Rec. ITU-R [SM.1054-1](#) (Approved in Aug. 2019)
- ✓ **Studies on DVB-T/T2 coverage measurements and evaluation of planning criteria**
  - Rec. ITU-R [SM.1875-3](#) (Approved in Aug. 2019)
- ✓ **Studies on EMF measurements to assess human exposure**
  - **New** Report ITU-R [SM.2452-0](#) (ex.[EMF-MON]) (Approved in June 2019)
- ✓ **Studies on Cooperation in the field of space radio monitoring**
  - **New** Report ITU-R [SM.2453-0](#) (ex.[SAT MON COOPERATION]) (Approved in June 2019)



# WP 1C approved publications after May-June 2019 (2/2)

- ✓ **Studies on Assessment of electromagnetic environment in the GNSS frequency bands**
- **New** Report ITU-R [SM.2454-0](#) (ex. [MEAS-GNSS]) (Approved in June 2019)
  
- ✓ **Studies on Measurement facilities available for the measurement of emissions from both GSO and non-GSO space stations**
- Report ITU-R [SM.2182-3](#) (Approved in June 2019)
  
- ✓ **Studies on Spectrum Monitoring Evolution**
- Report ITU-R [SM.2355-1](#) (Approved in June 2019)
  
- ✓ **Studies on Spectrum management and monitoring during major events**
- Report ITU-R [SM.2257-5](#) (Approved in June 2019)
  
- ✓ **Review of relevant [ITU-R](#) Recommendations in SM series**
- 30 ITU-R Recommendations related to the WP 1C activities were editorially updated in June 2019